Ourston Roundabout Engineering

July 7, 2009

Maine Bureau of Transportation Systems Planning
16 State House Station
Augusta, ME 04333-0016

Attention: Mr. Darryl Belz, P.E.

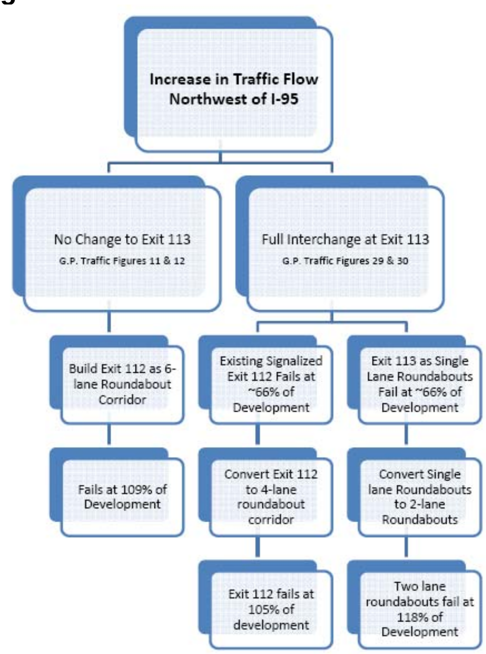
Re: Roundabout Analysis and Design Services
Augusta, I-95, Exits 112 & 113
Augusta, ME

This letter documents the analysis and conceptual roundabout geometrics for inclusion in your Interchange Justification Report for the I-95 Exit 113 interchange. The conditions for which we considered roundabout intersections are:

1. Exit 112 with no improvement to Exit 113 (No-Build)
   a. Traffic Analysis
   b. Conceptual Roundabout Design
2. Exit 113 reconfigured as a full interchange with roundabouts at both Exit 112 and Exit 113
   a. Traffic Analysis
   b. Conceptual Roundabout Design

Figure 1 shows the steps to accommodate increase in traffic volumes utilizing roundabout corridors for Exits 112 and 113.

Figure 1



Traffic Volumes

Forecast 2028 peak hour (AM and midday) volumes developed by Gorrill-Palmer Consulting Engineers were used in the traffic analysis. Traffic volume projections for both the build and the no-build condition were utilized for the various scenarios.

Traffic Analysis

Owing to the proximity of the roundabouts and the short weaving distance between them, operations of the roundabouts are linked and must be evaluated jointly. The primary Measure of Effectiveness for a roundabout or other intersection treatment is delay, which is defined by Level of Service (LOS). Queue length is a function of delay and is an important consideration as well. For this study, LOS D for the AM and midday periods has been established as the minimum acceptable level of service.

The traffic operations for the intersections were analyzed using RODEL 1.9.7 roundabout design and capacity analysis software. The 50th percentile confidence level (CL) was used in the RODEL capacity analysis to represent the most probable capacity of the roundabout, and to be consistent with confidence levels inherent in typical signalized and unsignalized capacity analysis methodologies. Similarly, average delay, as opposed to maximum delay, was used to be consistent with signalized and unsignalized methodologies. We have also performed capacity analysis at an 85 percent confidence level to determine if the forecasted level of service and average delay is predicted to be in the sensitive area of the delay curve.

When considering the operation of two or more roundabouts in close proximity to each other, the expected queue length at each roundabout becomes more important. In this study the expected queues for each approach have been computed to check that sufficient queuing space is provided for vehicles between the roundabouts. If space between intersections is not sufficient to store the 95th percentile predicted maximum queues, then the operations predicted by RODEL cannot be realized.

A further complication of closely spaced intersections at ramp terminals is lane utilization and lane continuity. In series, roundabouts must be configured to feed traffic from an upstream exit of one roundabout such that lane utilization and lane continuity promote minimal lane changes and maximum lane use downstream. Designs must account for upstream lane choice and downstream lane use otherwise capacities can be overestimated and queuing can be underestimated.

Geometric Design Criteria

Historically, ramp terminal roundabouts were configured using a rain-drop style configuration that closes off the circle where no circulation is needed. More recently this type of layout has been abandoned for a fully open circulating roadway. The benefits include the allowance for u-turns and the apparent psychological yielding that is thought to improve capacity of downstream affected entries, e.g. ramps.

The entry path deflection determines entry speed which affects the frequency and severity of collisions between entering and circulating traffic. It is apportioned based on the combination and proportion of the conflicting streams of traffic. The roundabouts were designed to keep speeds below 28 miles per hour while balancing other competing geometric criteria. The roundabout concepts were developed to accommodate large trucks, provide adequate sight distance and vision outlook, and provide natural vehicle paths.

Additional effort to optimize these designs will be required for detailed design. The possible modifications include slight shifts in circle location, alignment adjustments, and development of optimal entry/exit paths. Final geometric layouts for the roundabouts would require a more detailed design examination accounting for fastest path and truck path requirements. These geometric considerations affect the safety and capacity performance of roundabouts.

Conclusion

It is generally recognized that capacity of interchange intersections that have traffic signals at their ramp terminals ultimately fail with relatively low increases in demand from specific turning movements because of short intersection spacing creating limited back-to-back left turn queue storage. The benefits of traffic signal coordination are limited because the turning movements and not the through movements need extra green time. Historically, traffic signals have limited effectiveness in this context and will eventually fail because of complications of tight intersection space. Accommodating traffic signals in this context requires wide bridge cross-sections to provide turn lanes between closely spaced ramp terminals.

Modern roundabouts are an effective countermeasure both for congestion reduction and safety improvements at interchange configurations. This study identifies the property, access, and cost of implementing functional modern roundabouts at Exits 112 and 113.

Yours truly,

OURSTON ROUNDABOUT ENGINEERING, INC.

Troy Pankratz

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